Product chain collaboration for sustainability – A business case for life cycle management

Received: 15 May 2018 | Revised: 31 July 2019 | Accepted: 19 August 2019

DOI: 10.1002/bse.2388

RESEARCH ARTICLE

WILEY Business Strategy and the Environment

Product chain collaboration for sustainability: A business case for life cycle management

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Abstract

Life cycle management (LCM) is frequently described as a holistic sustainability perspective along the product chain. It has mainly been a company internal practice. However, recent developments reveal a new type of LCM where companies collaborate in product-chain-specific initiatives. This raises questions concerning why corporations extend "corporate LCM" toward "product chain LCM". Here, we explore rationales and challenges for corporations engaging in one such coalition: The Sustainable Transport Initiative. The study covers five companies in different product chain positions and practitioners in different corporate functions. The results show a broad range of rationales for engaging in product chain LCM, related both to self-interest and a shared interest in the product chain. The importance of the "business case," both for the individual companies and the product chain, is identified. The importance of sustainability managers as actors and as facilitators in discussions between managers from different corporate functions is also identified.

KEYWORDS

business case, challenges, collaboration, life cycle management, rationales, sustainable business

1 | INTRODUCTION

Companies play a vital role in the transition toward sustainable development. Traditionally, focus is on in-house environmental impacts (Meima, 2002; Welford, 1999), sometimes referred to as corporate environmental management (CEM). However, an extension of this corporate focus in CEM toward encompassing the entire product chain has been suggested as vital when striving for sustainable development (De Bakker & Nijhof, 2002; Jørgensen, 2008; Meehan & Bryde, 2011; Sánchez, Wenzel, & Jørgensen, 2004; Schnittfeld & Busch, 2016; Welford, 1993; Welford, 2003). This leads to life cycle management (LCM), which means a perspective where the environmental impacts along *whole* product life cycles are considered (Balkau & Sonnemann, 2010; Baumann & Tillman, 2004; Power, 2009; Poikkimäki, 2006; Remmen, Jensen, & Frydendal, 2007; UNEP/SETAC, 2012).

In the LCM literature, internal and external collaboration is often highlighted as important (see e.g. Bey, 2018; Fava, 1997; Hunkeler et al., 2003; Linnanen, 1995; Remmen et al., 2007; Sonnemann, Gemechu, Remmen, Frydendal, & Jensen, 2015; Swarr & Fava, 2007). However, previous studies show that in practice, LCM has been a company internal activity as "corporate LCM" (Baumann, Lindahl, Scandelius, Schmidt, & Sonnemann, 2017; Nilsson-Lindén, Baumann, Rosén, & Diedrich, 2018; Sánchez et al., 2004). However, recent developments reveal a new type of LCM practice, one in which multiple industry actors join product-chain-specific initiatives to make product chains more sustainable. Such "product chain LCM" is a considerable step from individual corporate LCM activities and toward "product chain coalitions", using a term by Boons (2000).

Given the preference for corporate LCM in the past, the reasons for corporations to enter product chain coalitions are not clear.

Previous research has pointed to the interdependence of companies in product chains as a way of gaining more sustainable practices (see e.g. Carballo-Penela, Mateo-Mantecón, Alvarez, & Castromán-Diz, 2018; De Bakker & Nijhof, 2002; Handfield, Sroufe, & Walton, 2005; Schnittfeld & Busch, 2016) and implied as a possible way of competing not between companies, but between product chains (Gold, Seuring, & Beske, 2010). However, literature reviews conclude that we still know little about the actual rationales and challenges for companies and practitioners for engaging in product chain LCM (see e.g. Giunipero, Hooker, & Denslow, 2012; Lozano, 2015; Sánchez et al., 2004). Therefore, the questions here become: why do companies expand their individual corporate LCM activities toward a collaborative LCM practice, and what challenges do they encounter when doing so?

As product chain LCM is rare in practice, this study of the collaboration in the Sustainable Transport Initiative—a product-chain-specific initiative for sustainability, provides valuable insights into the reasons and conditions for product chain LCM. As such, we explore the rationales and challenges of this practice, based on a detailed empirical study of multiple companies. With our paper, we adhere to earlier calls for studies where data collection extends the single company approach to provide knowledge about the collaboration between product chain actors (Seuring & Gold, 2013; Vermeulen & Seuring, 2009).

2 | BACKGROUND

2.1 | LCM—corporate-based and as product chain collaboration

The LCM concept entails a focus on the minimization of environmental and socioeconomic burdens associated with products throughout the entire life cycle (Remmen et al., 2007), taking place through coordinating environmental concerns and management in the whole life cycle, instead of being independent concerns in each company (Baumann & Tillman, 2004). A common tool used for gaining knowledge on product environmental impact along the life cycle is life cycle assessment (LCA). As products are key links between companies in a product chain (Berkhout & Howes, 1997), companies have a good starting point for LCM (Boons & Berends, 2001).

Because the environmental impact of a product depends on the material, design, technology and production choices made by different companies in the product life cycle, a collaborative approach to managing the product environmental impact is important to avoid problem-shifting between different companies. Collaboration, as well as integration of LCM into all corporate functions, are therefore pointed out as important in the LCM literature (see, e.g. Bey, 2018; Fava, 1997; Hunkeler et al., 2003; Linnanen, 1995; Remmen et al., 2007; Sonnemann et al., 2015; Swarr & Fava, 2007). Also, top management support is considered key for LCM engagement (Balkau & Sonnemann, 2010; Broch, Warsen, & Krinke, 2015; Hunkeler et al., 2003; Remmen et al., 2007).

There are thus environmental rationales for collaboration along the product chain given by the life cycle perspective. But with corporate LCM, environmental problem-solving becomes limited to what can be done within the control and the interest of the company; with product chain LCM, the scope for environmental control and decision-making is extended, enabling the coordination of product environmental management. The question arises how this holds up in a business context.

LCM, *in theory*, suggests the involvement of all product chain actors, however this has rarely been the case in practice (Baumann et al., 2017; Nilsson-Lindén et al., 2018; Sánchez et al., 2004). We know from previous studies that the product chain position has relevance for company adoption of LCA (Berkhout & Howes, 1997), but it seems that companies have not chosen the path of *product chain* collaboration. Lately, however, a new type of LCM practice has emerged in which companies along the product chain join forces to create collaborative LCM practice, with the intention to jointly influence environmental impacts in their product chains. However, studies of such practice are scarce. A recent report indicates that the current state of joint industry initiatives for collaborative LCM presents a heterogenic picture with a wide range of tools used (Müller & Bessas, 2017), but little is still known about the details of this practice. The current paper thus aims to explore this practice in detail.

2.2 | Sustainability collaboration in industry

It has been indicated from desktop research that business value, leverage, and leadership are drivers for industry LCM initiatives (Radhakrishnan, 2015). With such initiatives, companies are proposed the opportunity of identifying hotspots, improve products accordingly, and promote them to the market (Saling, 2015). And as multinational retailers and manufacturers have the possibility to drive sustainable product design throughout their life cycles (Golden, Subramanian, & Zimmerman, 2011), with collaboration toward shared goals, companies are said to have the possibility to address some of the critical environmental problems the world faces, while also strengthening their own resilience to global challenges (Saling, 2015). Fieldwork, on the other hand, has shown that companies joined in an industry initiative, in response to increased globalized competition, external pressure to demonstrate transparency on environmental and social performance in their product chains, and the increasing effects of climate change on their resources (via e.g. droughts) (Freidberg, 2017). Many of the companies also joined the initiative in order to "secure a seat at the table where their biggest customer would be deciding how to measure product sustainability" (p. 1395).

2.3 | Rationales and challenges for sustainability efforts

Although research on product chain LCM is scarce, research exists on the rationales and challenges of various sustainability efforts in the industry. For example, rationales and challenges have been studied from the perspective of implementation of environmental strategies in manufacturing companies (Bey, Hauschild, & McAloone, 2013), purchasing and supply management sustainability (Giunipero et al., 2012),

environmental supply chain management practices (Walker, Di Sisto, & McBain, 2008), or corporate LCM (Sánchez et al., 2004).

Leadership commitment is frequently identified as a driver in literature (Giunipero et al., 2012; Sánchez et al., 2004; Walker et al., 2008), as well as regulation (Bey et al., 2013; Giunipero et al., 2012; Sánchez et al., 2004) and customer demand (Bey et al., 2013; Sánchez et al., 2004). Competitive advantage is another important driver identified (Bey et al., 2013). Improved business conditions and internal environmental awareness have been indicated as drivers for corporate LCM (Sánchez et al., 2004). Lozano (2015) summarizes that important *internal* drivers for corporate sustainability are leadership together with the "business case", whereas reputation, customer demands and expectations, and regulation and legislation are *external* drivers.

There are more studies focusing on the rationales for sustainability than on the challenges (Walker et al., 2008). Nevertheless, it is noted that identified barriers include, for example, lack of information and data, lack of resources (Bey et al., 2013; Sánchez et al., 2004), as well as complicated tools, technical difficulties, difficulties in defining and sharing responsibility within product chains, and lack of internal management support (Sánchez et al., 2004). Other barriers identified in relation to environmental supply management is regulation, customers, competition, and public pressure (Walker et al., 2008), as well as investments in sustainability and economic uncertainty (Giunipero et al., 2012). Some of the aspects reoccur as either rationales or challenges, as sometimes they can act as both (Walker et al., 2008). Also, rationales and challenges might vary in importance for different organizations, as shown by Giunipero et al. (2012).

2.4 | Collaboration among practitioners

Collaboration in product chains requires the involvement of practitioners in different corporate functions, from different product chain actors. Therefore, it is relevant to take a practitioner perspective. Hahn, Preuss, Pinkse, and Figge (2014) have described how "sustainability confronts managers with situations in which they need to simultaneously address multiple desirable but conflicting economic, environmental, and social outcomes at firm and societal levels that operate in different time frames and follow different logics" (p. 466). In these situations, managers are said to hold different cognitive frames. Within a "business case" mind frame, sustainability issues with a clear connection to economic attributes are prioritized. With a "paradoxical" frame, sustainability aspects are viewed broadly, not only in relation to economic factors (Hahn et al., 2014). Hahn et al. (2014) concluded that managers with both types of cognitive frames are needed in order to tackle the prevalent challenge of sustainable development. This has relevance for product chain collaborations, as practitioners from different corporate functions and with different cognitive frames collaborate. Additionally, Freidberg (2017) suggested that joint industry initiatives are a way for practitioners from different companies to create a common understanding of what sustainability means in their industry context. Global collaboration among life cycle professionals from different organizations has also been suggested as vital in order to improve the uptake of life-cycle-based approaches in business (Strothmann, Bricout, Sonnemann, & Fava, 2015).

In sum, joint industry initiatives for collaborative LCM is a new and emerging practice. Some research has been conducted on rationales and challenges for corporate sustainability, but little is still known in relation to collaborative LCM practice between companies in product chains. Therefore, in this empirical study, we explore the rationales and challenges of product chain LCM practice, from the perspective of practitioners in different corporate functions and from companies in different product chain positions.

3 | METHOD

In order to gain a rich understanding of LCM as it is practiced in and between companies in a product chain, this study explored the rationales and challenges of this practice by focusing on a product chain including five companies. With such an approach, data collection is conducted at multiple settings, the importance of which has been called for in previous research (Seuring & Gold, 2013; Vermeulen & Seuring, 2009). The study was designed as a product chain organization (PCO) study (Baumann, 2012), thus including multiple companies in different product chain positions. In total, five companies participated in the study (Figure 1): one material manufacturer (Company 1), one component manufacturer (Company 2), one sub-systems manufacturer (Company 3), one systems producer (Company 4), and one operator (Company 5). Four of these companies (Company 2–5) were part of a newly formed industry initiative, here referred to as the Sustainable Transport Initiative (STI). Also included in the study was Company 1, which was not part of the STI, but was influenced by the practices of the STI.

The STI is a product chain LCM initiative taking place within a subsection of the transport industry, aiming for improved sustainability performance of their product chains and improved efficiency of sustainability analysis of their upstream product chains. The STI included in total, at the time of the study, eight member companies. All of the member companies were given the opportunity of participating in the study. The participation of four of the member companies was a result of (a) the researchers' wish to identify an actual and specified product chain of companies to interview (i.e. the companies acted as suppliers to each other regarding a specific product) and (b) the interest (and resources available) of the companies participating in the study (see Figure 1 below).

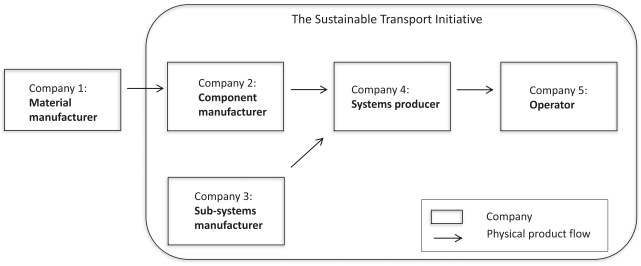

FIGURE 1 The studied product chain included five companies (i.e. the boxes), of which four companies (2-5) were members of the STI. Arrows indicate material/product flow

3.1 | Empirical data

Interviews of about 1–1.5 hr each were conducted with 13 practitioners within the five participating companies (including Company 1; see Table 1). A pragmatic approach was applied; interviews were first conducted with those practitioners acting as contact persons of the STI in each company. Snowball sampling (see Bryman & Bell, 2007) was then applied to identify additional interviewees when possible. The interviewees were positioned in different functions of the companies depending on the internal organization of the company and depending on the results of the snowball sampling. This process generated interviewees in three different functions: sustainability, purchasing, and sales. Hereon, these practitioners are referred to as either sustainability, purchasing, or sales managers.

The number of interviewees at each company varied, which was a result of three different reasons: (a) the participating companies had different organizational resources available for participation in the STI, (b) the participating companies had differences in how the participation in the STI was organized and managed internally (e.g. regarding number of people involved), and (c) one of the participating companies (Company 2) had previously been active in a company-academic collaboration on the topic of sustainability and LCM, resulting in a higher number of interviewees.

The previous company-academic collaboration (of which all current authors participated) provided an access point to industry actors within Company 2, who were interested in increased competence in the field of LCM. As such, the current study was initiated shortly after the entry of Company 2 into the STI (see Section 4 for more details about the formation and organization of the STI).

During the interviews, the aim was to gain knowledge of the rationales and challenges of engaging in product chain collaborations for LCM. This means efforts were made to understand the reasons for consciously arriving at such a decision—the "rationale" for action—why the choice was made and the information this choice relayed on (see www.businessdictionary.com). Focusing on rationales has previously been used in studies of firm collaboration (see e.g. Broström, 2012). Interviews are one way of seeking information on rationales for action. In this study, semi-structured interviews with open-ended questions were used during the intensive interviews (Charmaz, 2006). This allowed for follow-up questions and detailed discussions (Charmaz, 2006). The questions posed during the interviews related to different aspects: (a) the interviewee and his/her position, working assignments, and role in relation to the STI, (b) the reasons for and process of joining the STI, (c) the tool for sustainability assessments (here referred to as EcoTool), its content, its use in the organization, and potential results it had generated, (d) the organization and management of the STI in the company, (e) collaboration and communication between companies regarding the participation in the STI and/or the use of EcoTool, and (f) recommendations for the future or regarding a hypothetical "do-over".

The interviews were conducted by one of the researchers and were audio-recorded and transcribed (see Silverman, 2011). The study was conducted over a period of 18 months, between December 2016 and May 2018, at a time when the STI was recently launched, when more member companies were joining, and when there were a lot of ongoing discussions about the organization and continued development of the STI. As the interviews unfolded during the ongoing formation of the STI, this generated the advantage of real-time material, as opposed to the possibly flawed retrospective accounts (Golden, 1992).

Interviews provide one way of gaining information on rationales and challenges. However, to complement this approach, documents (Table 2) were also collected and analyzed, including annual reports, documents regarding EcoTool and the STI, STI newsletters/press releases, articles on the STI, the STI Internet pages, and e-mails regarding the STI that were shared with the authors by participants of the STI. The total number of documents in the empirical material amounted to 43 documents. The documents provided additional insights into the practice of collaborative LCM in the STI. It could be argued that rationales are difficult to completely identify in interviews.

TABLE 1 Details regarding type of companies, number of interviewees per company, and type of practitioners

Type of company	Number of interviewees per company	Type of practitioner
Company 5: Transport operator	2	Purchasing manager A Purchasing manager B
Company 4: Transport producer	1	Purchasing manager
Company 3: Sub-systems manufacturer	2	Sustainability manager Purchasing manager
Company 2: Component manufacturer	6	Sustainability manager A Sustainability manager B Purchasing manager A Purchasing manager B Sales manager A Sales manager B
Company 1: Material manufacturer	2	Sustainability manager Sales manager
Total number of interviewees	**13**	

TABLE 2 Details regarding collected and analyzed documents (primary and secondary data)

Type of document/content of document	Number of documents per type of document
Annual reports of the STI	2
Documents regarding EcoTool	6
Documents regarding the STI	11
STI newsletters/press releases	10
Articles on the STI	4
The STI homepage	1
E-mails regarding the STI	9
Total number of documents	**43**

Abbreviation: STI, Sustainable Transport Initiative.

However, the detailed discussions provided a large amount of data on the subject, which were then thoroughly analyzed by the three researchers.

3.2 | Analysis

As a first step of the analysis, an empirical narrative of the formation of the STI was constructed, based on the 13 interviews and the document studies. In parallel, the collected material was coded, using a research software which aided the coding and organization of the qualitative research material (QSR NVivo 11). The codes were derived from the empirical material, generating themes such as (a) rationales for joining the initiative, (b) challenges of the initiative, (c) governance of the initiative, (d) company internal collaboration, (e) company external collaboration, and (f) discussions on tools (see Table 3 for exemplification of one of the coding exercises for the identified rationale "learn from joint LCM collaboration").

The coding process was further followed by an additional analysis of the rationales and challenges expressed by interviewees, from the perspective of "different" practitioner roles (sustainability, purchasing, sales) and from the perspective of different company positions in the product chain (material manufacturer, component manufacturer, subsystems manufacturer, systems producer, and operator). Such analysis provided the possibility to compare results not only between company position in the product chain, but also between groups of managers, employed at different departments.

TABLE 3 Exemplification of one of the coding exercises for the identified rationale "learn from joint LCM collaboration"

Example of quotes	Thematic code
"I could motivate our participation in this as a way to understand better how we can work in such an association [the STI] to actually contribute to the development of it."	Learn from joint LCM collaboration
"We hope that we will learn from this collaboration, and that it will generate new ideas."	
"… because we learn from the STI. It is good best practice sharing, good benchmarking with other companies. And the communication in our meetings are extremely fruitful and helpful."	
"I think it could be very useful and interesting if we share experiences and practices, how each company does it. E.g. all of us have policies but which once are taken seriously and why?"	
"… gives us the advantage to communicate in a very direct way and a very frequent way and a very open way."	

Abbreviations: LCM, life cycle management; STI, Sustainable Transport Initiative.

3.3 | Methodological approach

With this study approach, the aim was to provide "thick" descriptions of data (Flyvbjerg, 2006) that provide a rich and nuanced understanding of the organization of complex issues (Nicolini, 2012). This type of approach is the basis of interpretative and constructivist management research (Czarniawska, 2014a). Following this logic, the PCO approach provides a good basis for collecting data from several companies engaged in the same phenomenon (i.e. product chain LCM). This type of studies of phenomenon, or cases, are often considered difficult to generate generalizations from. However, as Flyvbjerg (2006) point out, such detailed and specific knowledge can still be "enter[ed] into the collective process of knowledge accumulation in a given field or in a society" (Flyvbjerg, 2006, p. 227), as "thicker, not thinner, descriptions are the aim of good social science" (Nicolini, 2012, p. 215). This need of case-specific data is especially true when studies are conducted for new types of phenomenon, as in this case of collaborative LCM between product chain actors, as a joint industry supply chain initiative. Thus, depth of data is here favored over generalizability, yet, valuable analysis and results can still be gained from the empirical material.

Although the empirical material in this study (i.e. interviews and document studies) has mainly an interpretative nature (see Czarniawska, 2014a), some of the material in the Results section is presented as quantitative data. Here, this serves as a way to present indications of size and grounds for interpretation, rather than as grounds for statistical presentations (see, e.g. Czarniawska, 2014b).

4 | FORMATION OF THE STI

In 2014, key actors within a subsection of the transport industry gathered at a meeting to discuss the potentials of a joint initiative for sustainable procurement. "The idea was basically to join forces and bring the same level of transparency in data quality into this group of key organizations in the [transport] industry," the procurement manager of one company explained. The year after, in 2015, the STI was launched with six members, including operators, systems producers, and manufacturers. It grew later to include eight members in 2018. The aim of the initiative was to continuously improve sustainability practices throughout the industry supply chain, to improve the efficiency of the analysis of sustainability performance, and to share best practice.

The governance of the STI was divided into two committees: (a) a leadership committee, consisting of the chief purchasing officers (or equivalent) of the member companies, and (b) a membership committee, consisting of the companies' heads of Sustainability and/or heads of Sustainable Procurement (and/or delegates of the company's chief purchasing officers). The STI was facilitated by a non-profit organization experienced in facilitating sustainability business collaborations.

At the launch, it was decided that the member companies of the STI would make use of a sustainability assessment tool called EcoTool for a certain number or percentage of their suppliers. This meant that supplier companies were asked to enter their company details about

environment, social, ethical, and supply chain management into a given questionnaire. The results would then be assessed by a team from EcoTool, resulting in a sustainability score of the supplier. The results of this assessment could then, if the supplier agreed, be shared with several of their customers. This procedure had the advantage of saving organizational resources, as companies would not need to be assessed multiple times by several companies. In practice, this meant that each STI member company would implement the use of EcoTool into their purchasing processes, thereby creating a "relay" of requests for sustainability purchasing information in the product chain. Later, as the formation of the STI progressed, it was decided that other alternative sustainability assessments were to be accepted.

5 | RESULTS

5.1 | Rationales for product chain LCM practice

The results show that three of the identified rationales from the interviews relate closely to the explicitly stated aims of the STI: to "increase efficiency through shared practice"; to "improve sustainability performance in the product chain"; and to "learn from joint LCM collaboration". However, nine additional rationales were also identified in the empirical material. The identified rationales for product chain LCM could be referred to two major categories: those that focus on the gains of participation in the LCM collaboration from the perspective of individual companies and those that express benefits of a product chain perspective (see Table 4). Product chain focused rationales related both to the upstream product chain (also known as the supply chain; e.g. improved sustainability performance or risk management of suppliers) or the upstream and downstream product chain (supply chain *and* customers/consumers focused; e.g. influencing the industry sustainability agenda). Two of the identified rationales are characterized as company *and* product chain focused. This dual focus implies that the individual company is the actor in focus, but that the external pressure of the rationale is stemming from downstream actors or regulations requiring an extended LCM perspective in the upstream product chain.

In sum, the results show a broad range of rationales for product chain LCM practice, in addition to those explicitly stated as aims for the STI. Whereas some rationales focus on the benefits of product chain collaboration, others focus on the company's own gain from the collaboration.

5.2 | Rationales among practitioners in different corporate functions

The results show that the different practitioner roles, sustainability, purchasing, and sales managers, expressed both similar and different

TABLE 4 Twelve identified rationales for product chain LCM practice, including focus and descriptions

Identified rationales	Focus	Exemplification from the empirical material
Develop new business opportunities	Company	Development of new business opportunities (e.g. development of new products, sales of "greener" products, and increased sales) resulting from the new collaboration and the increased integration of sustainability aspects into purchasing processes
Strengthen brand image	Company	Possibilities of company profiling, marketing, or other external communication, in order to strengthen brand image
Gain competitive advantage	Company	Viewing sustainability and the STI involvement as a differentiator in a competitive market
Evolve company internal sustainability work	Company	The STI involvement and/or EcoTool management being an evolvement of company internal sustainability work
Learn from joint LCM collaboration	Company	Learn from joint industry discussions and best practice sharing on LCM collaboration through the STI forum
Comply with customer requirement	Company & Product chain	Requirement and/or pressure by customer on the supplier to participate in the EcoTool assessment and/or the STI
Adhere to general stakeholder expectations	Company & Product chain	Expectations by stakeholders other than customers (e.g. investors, governments, NGOs and law, regulations, and management standards) on the company to participate in LCM practices (e.g. the STI)
Increase efficiency through shared practice	Product chain	Expectations of increased LCM efficiency through shared industry practice
Improve sustainability performance in the product chain	Product chain	Aims and/or responsibilities toward improving sustainable performance in company product chains
Improve risk management	Product chain	Improved risk management through enhanced identification and management of product chain sustainability risk
Gain leverage towards other actors	Product chain	Gain leverage toward other actors (e.g. suppliers, competitors, and politics) as strength in numbers and influence
Influence the industry sustainability agenda	Product chain	Company possibility to join industry discussions and actively influence the industry sustainability agenda

Abbreviations: NGOs, non-governmental organizations; LCM, life cycle management; STI, Sustainable Transport Initiative.

rationales (see Figure 2). The most frequently expressed rationale was to "develop new business opportunities," which was expressed by all three practitioner roles. From Figure 2, we also see that the top rationales for purchasing managers were to "improve sustainability performance in the product chain" and to "improve risk management." For sales managers, the top rationales were to "develop new business opportunities", to "strengthen brand image," and to "comply with customer requirement." For sustainability managers, they were to "evolve company internal sustainability work," together with to "develop new business opportunities", to "comply with customer requirement", to "learn from joint LCM collaboration", and to "improve sustainability performance in the product chain". The greatest difference among practitioner roles was found for three of the rationales: to "improve risk management", to "evolve company internal sustainability work", and to "comply with customer requirement". From this, we note that purchasing and sales managers have different top rationales. We see also that sustainability managers share top rationales with purchasing and sales managers. From Figure 2, we see also that sustainability and purchasing managers expressed more rationales than sales managers.

5.3 | Rationales among practitioners from different product chain positions

Most of the rationales were found to be independent of the product chain position (Table 5). Practitioners in almost all companies expressed the rationales to "develop new business opportunities," to "improve sustainability performance in the product chain", to "gain leverage toward other actors," and to "evolve company internal sustainability work". An exception is found for "influence the industry sustainability agenda." This rationale was specific for two of the companies, which are both upstream member companies of the STI; suppliers of sub-systems or components. The materials manufacturer and the systems producer expressed fewer rationales than other participating companies.

5.4 | Challenges in the formation of product chain LCM practice

Six types of challenges were identified (Table 6). Most of them referred to external aspects of the collaboration. Only two of them referred to internal challenges. However, references to the internal challenges were the most frequent ones. One of them is the need to "demonstrate a business case of the STI." It is the opposite reflection of the most stated rationale for the collaboration—"develop new business opportunities." The other is the challenge for the STI to achieve "STI outcomes into core company processes." This shows that although the companies have started the process of engaging in the STI and the STI having close ties with purchasing and sustainability functions, there are concerns regarding how STI outcomes and practices can be incorporated into each member company's core processes.

5.5 | Challenges among practitioners in different corporate functions

The perceptions as to what constitutes challenges regarding the STI are mostly shared among the different practitioners (see Figure 3). The two internally focused challenges were expressed by practitioners from all three corporate functions. Top challenges among sustainability and sales managers related to "demonstrate a business case," to have "STI outcomes into core company processes," and "differing focus among member companies." Purchasing managers also shared these two, but also expressed concern for "STI outcomes being relevant for multiple industry suppliers" and "anti-trust regulations in collaborative LCM practice." The results in Figure 3 also show how sales managers expressed fewer challenges than sustainability or purchasing managers.

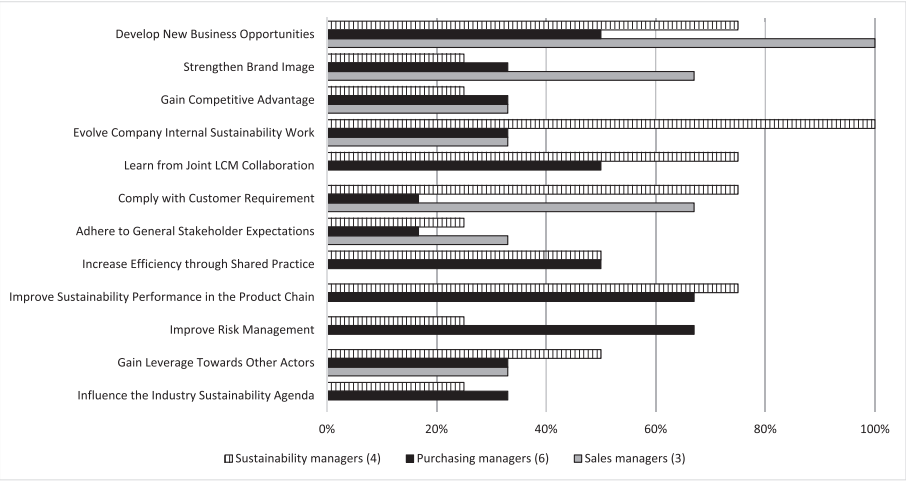

FIGURE 2 Twelve identified rationales for product chain LCM practice, distributed by sustainability, purchasing, or sales managers. Bars represent the percentage of the total number of managers expressing the rationale. Abbreviation: LCM, life cycle management

TABLE 5 The twelve rationales for product chain LCM practice, divided by the company position in the product chain

Identified rationales	Manufacturer (material)	Manufacturer (component)	Manufacturer (sub-system)	Producer (system)	Operator
Develop new business opportunities	■	■	■		■
Strengthen brand image	■	■		■	
Gain competitive advantage		■		■	■
Evolve company internal sustainability work	■	■	■	■	■
Learn from joint LCM collaboration		■	■		■
Comply with customer requirement	■	■	■		
Adhere to general stakeholder expectations	■	■			■
Increase efficiency through shared practice	■		■	■	■
Improve sustainability performance in the product chain		■	■	■	■
Improve risk management		■	■		■
Gain leverage towards other actors		■	■	■	■
Influence the industry sustainability agenda		■	■		

Note. Gray boxes represent a challenge being expressed by at least one practitioner at the company.

Abbreviation: LCM, life cycle management.

TABLE 6 Six identified challenges in the formation of product chain LCM practice, including focus and descriptions

Identified challenges	Focus	Exemplification from the empirical material
Demonstrate a business case of the STI	Internal	A need to demonstrate a business case of the STI in terms of business opportunities or improved risk management
STI outcomes into core company processes	Internal	Difficulties and future need of integrating the STI outcomes into core company processes
Differing focus among member companies	External	Differing focus and opinions on the development of the STI among the member companies
STI outcomes relevant for multiple industry suppliers	External	Difficulties of applying individual industry standards due to suppliers being active in multiple industries
Including suppliers in the STI processes	External	Challenges in having suppliers take part in the STI practices (i.e. EcoTool management)
Anti-trust regulations in collaborative LCM practice	External	Difficulties of collaborating with industry partners on LCM while also adhering to anti-trust regulations

Abbreviations: LCM, life cycle management; STI, Sustainable Transport Initiative.

5.6 | Challenges among practitioners from different product chain positions

The two company internal challenges were expressed irrespective of the product chain position, as seen in Table 7. Systems producers saw fewer challenges than the other participating companies; the operators saw more challenges than the others.

6 | DISCUSSION

Collaboration on LCM between companies in product chains has emerged as a new practice of LCM. In this study, we had the possibility to gain valuable knowledge on the rationales, and challenges, of extending the traditional "corporate LCM" toward "product chain LCM", by interviews with managers in five companies in different product chain positions. As this practice is rarely studied, this current study serves as an opportunity to gain insights into an area, which for long has been elevated in LCM literature, but rarely practiced in industry.

As Boons (2000) noted, product chain collaboration is not "just" about collaboration, as often indicated in LCM literature. It implies the creation of new external coalitions between product chain actors and a considerable step beyond corporate LCM. Reasons for taking this step have here been explored, and these have been found to be numerous and differing for different practitioners and product chain positions.

6.1 | Identified rationales and challenges for product chain LCM

The explicitly stated aim of the STI was to continuously improve sustainability practices throughout the industry supply chains and to improve the efficiency of the analysis of sustainability performance in the supply chain. The aim was also to share best practice and to use and share common tools in order to create efficiencies and to promote greater transparency within the industry. Some of the expressed rationales in interviews related clearly to these aims; however, many of the expressed rationales were in addition to these official aims. This shows that the participating practitioners found many additional rationales for engaging in the initiative.

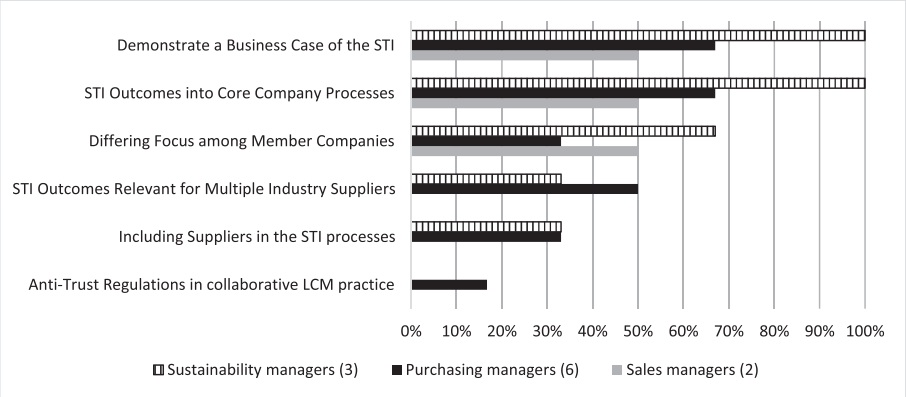

FIGURE 3 Six identified challenges in the formation of product chain LCM practice, distributed by sustainability, purchasing, or sales managers. Bars represent the percentage of the total number of managers expressing the rationale. Abbreviations: LCM, life cycle management; STI, Sustainable Transport Initiative

TABLE 7 The six expressed challenges in the formation of product chain LCM practice, divided by the company position in the product chain

Identified challenges	Manufacturer (component)	Manufacturer (sub-system)	Producer (system)	Operator
Demonstrate a business case of the STI	■	■	■	■
STI outcomes into core company processes	■	■	■	■
Differing focus among member companies	■	■		■
STI outcomes relevant for multiple industry suppliers		■	■	■
Including suppliers in the STI processes	■	■		■
Anti-trust regulations in collaborative LCM practice				■

Note. Gray boxes represent a challenge being expressed by at least one practitioner at the company.
Abbreviations: LCM, life cycle management; STI, Sustainable Transport Initiative.

The identified rationales had both a company internal focus and a product chain focus. Many company internal rationales show that the participating companies motivated their engagement with "self-interest," and value creation for the individual company. The product-chain-focused rationales show that the companies also motivated their engagement with a "shared interest" in the product chain. Thus, although the STI entailed product chain LCM practice, with focus on sustainable product chains, each company still expected internal gains from their involvement in the STI. The result also shows that organizational or economic aspects dominated in the rationales, whereas environmental aspects were less expressed by the practitioners.

In our PCO study, we identified a divide in company internal rationales or product-chain-focused rationales. Corporate sustainability literature on the other hand often focuses on "internal" and "external" drivers (Lozano, 2015), where external drivers include actors such as government, universities, non-governmental organizations (Lozano, 2015), or for example, regulation, customers, competition, and society (Walker et al., 2008). This means that product chain actors are not distinguished from other external actors. The focus on product chain actors in this current study on LCM thus address these specific external actors.

Several of the identified rationales are found in previous literature, such as rationales related directly to the benefits of the individual company: to "strengthen brand image" (Bey et al., 2013; Lozano, 2015) and to "gain competitive advantage" (Bey et al., 2013; Giunipero et al., 2012; Lozano, 2015; Walker et al., 2008).

We found here rationales specific to LCM. Some of these referred to external pressures from downstream product chain actors, such as customers or governments placing environmental expectations that require an LCM extended beyond the company itself and upstream in the product chain. The categories to "comply with customer requirement" and to "adhere to general stakeholder expectations" overlap to some extent with findings from previous studies (see Bey et al., 2013; Giunipero et al., 2012; Lozano, 2015; Sánchez et al., 2004; Walker et al., 2008). The most LCM specific type of rationales had a clear product chain focus, pointing to the gains of product chain collaboration, for example, the rationale to "improve risk management". Similar observations have been made by Walker et al. (2008) and Bey et al. (2013). However, several of the identified rationales have not been explicitly identified previously in empirical studies, for example, to "improve sustainability performance in the product chain," "increase efficiency through shared practice," "gain leverage toward other actors," "influence the industry sustainability agenda," "learn from joint LCM collaboration," "evolve company internal sustainability work." As this study was conducted as a PCO study, we had the possibility to include practitioners from companies in multiple product chain position and different corporate functions. This study design might explain why few other studies have identified these rationales.

The rare practice of product chain collaboration might also explain the lack of previously identified rationales for LCM.

6.2 | The significance of product chain position for product chain LCM

Studies have shown that product chain position has relevance for the adoption of LCA (Berkhout & Howes, 1997) and thus for activities of corporate LCM. However, the present paper showed, on the whole, that member companies of the STI shared many rationales and challenges for "product chain LCM", independent of product chain position. This sharing of rationales is interesting, as the companies' part of the study had different previous experiences with LCM activities. Yet, they expressed similarities in rationales for engaging in the collaboration. This indicates that the STI provided a good ground for collaboration (see Freidberg, 2017) and a much-needed community for LCM (see Strothmann et al., 2015).

Some significant differences were found, related to product chain position. Practitioners from supplier companies (i.e. manufacturers of sub-systems and components) expressed the rationale to "influence the industry sustainability agenda," which was not expressed by downstream actors in the STI (i.e. systems producers and operators). This could indicate that practitioners from upstream supplier companies saw a need of joining the STI, in order to actively influence the sustainability agenda (see Freidberg, 2017, for similar results) and ensure supplier considerations were taken in the STI discussions. This might be explained by the fact that the STI was formed by systems producers and operators, thus giving them the "upper hand" on setting the sustainability agenda. The suppliers who joined the STI later on were then motivated by the possibility to take part in discussions on the terms of the industry sustainability agenda.

Some of the results indicate that more differences owing to product chain position can be derived from the material. As an example, fewer challenges were expressed by the systems producer than the other participating companies. However, the variation in number of interviewees from the participating companies makes it difficult to draw any strong conclusions regarding the role of product chain position.

6.3 | Demonstrating a business case

LCM literature often points to the importance of leadership and top management commitment as key for LCM activity (see e.g. Balkau & Sonnemann, 2010; Broch et al., 2015; Hunkeler et al., 2003; Radhakrishnan, 2015; Remmen et al., 2007). Here, however, the empirical material points to the importance of the "business case," as key for this type of LCM. Parallels can be drawn to recent research on "corporate sustainability," which has identified the business case as an important driver (Lozano, 2015). Our results correspond to these findings (and somewhat similar findings by Sánchez et al., 2004 and Giunipero et al., 2012) and show how the importance of the business case holds as a rationale also in collaborative product chain LCM. The challenge to "demonstrate a business case" is also partly supported by findings by Walker et al. (2008) who identify cost reduction as a driver for implementing environmental supply chain management and Bey et al. (2013) who identify a lack of allocated resources as a barrier of implementing product life-cycle-oriented environmental strategies.

Although the business case is significant for the respective companies, identified rationales also show that the business case is important also from a product chain perspective. Identified rationales, such as to "gain leverage toward other actors" and to "gain competitive advantage," show that the companies saw the possibility of demonstrating a joint business case for the product chain and thus a way to compete based on the joint actions of the product chain.

6.4 | Premises for collaboration

The results showed that practitioners in different roles expressed different rationales and challenges within the same product chain collaboration. There may be several explanations for this. It might be explained by practitioners having different cognitive frames and thus different perceptions and interpretations of sustainability issues (Hahn et al., 2014). The rationale to "evolve company internal sustainability work" was one of the rationales expressed mainly by sustainability managers. This could be explained by sustainability managers having a wider perception of the scope of sustainability issues (paradoxical frame) than purchasing or sales managers. Sustainability managers could, with a paradoxical frame, incorporate rationales that relate to social, environmental, and economic aspects, even though the link to economic aspects might be less clear. To "improve risk management" was expressed by several of the purchasing managers, which could be related to their frame of reference being closer to a business case frame in which managers have a narrower scope of sustainability issues, specifying those that relate to economic aspects. In this case, improved risk management could assumingly lead to fewer costs related to environmental or sustainability risks related to supply of raw materials or components. This narrower scope on sustainability issues, related to a business case frame, might also explain why sales managers expressed fewer rationales and challenges than the other practitioner roles, as they might follow a logic of aligning sustainability issues specifically to economic rationales, thus identifying fewer rationales and challenges. As the results also showed, sustainability managers shared several of the top rationales with purchasing and sales managers. The role of the sustainability managers thus becomes important as an in-between coordinator or translator, in discussions with purchasing and sales managers, as sustainability managers hold a broader frame of mind and can facilitate understanding in-between other manager roles.

Almost all sustainability managers clearly expressed the rationale to "learn from joint LCM collaboration" (and some of the purchasing managers). This indicates that these practitioners saw a need for engaging with others, to learn how to manage life cycle activities and that an industry LCM initiative was considered a possible forum for such interaction and learning. This need for LCM collaboration is

also seen in the recent development of new LCM forums aiming to create communities for life cycle practitioners (Strothmann et al., 2015). The STI provides especially sustainability managers with a forum for discussion with practitioners with similar cognitive frames, as suggested by Hahn et al. (2014), in companies in other product chain positions and becomes thus a way to foster collaboration among sustainability practitioners (Freidberg, 2017). Discussions in the STI among managers with different cognitive frames and from different companies benefit practitioners, as this make grounds for fruitful discussions on how to bring about change toward enhanced LCM (Freidberg, 2017; Hahn et al., 2014).

A parallel and possibly concurrent explanation for the differences in expressed rationales is the relation in which the practitioners were in direct connection to, and management of, the STI. The sustainability and purchasing managers were those more directly connected to the management of the STI in the companies, whereas the sales managers were in indirect connection to the STI, for example, recipients of EcoTool requests from customers. This connection implies that purchasing managers, in this case, had gained a broader sense of the scope of sustainability issues because they expressed many of the same rationales as sustainability managers. Sales managers were less involved in the direct management of the STI, which might explain why they expressed fewer rationales and challenges than the other practitioner roles.

7 | CONCLUSIONS

The emerging practice of collaboration on LCM between companies in a product chain, as practiced within the STI, provided the possibility to study the rationales and challenges of taking steps and actions toward such extended LCM collaboration in industry. The aim of the study was to uncover details in product chain LCM practice, by exploring rationales and challenges from the perspective of different practitioner roles in companies in different positions in the product chain. The study is also a response to calls for studies of multiple product chain actors in the field of LCM (Seuring & Gold, 2013), as a contrast to the many studies of individual companies or overview surveys of industry sectors.

Using a PCO approach, we were able to identify and compare rationales and challenges related to different practitioner roles and product chain positions. Our findings show a broad range of rationales for engagement in product chain LCM, many additional to those explicitly stated as aims for the STI. The expressed rationales refer both to self-interest and possible gains for the individual company, but they also refer to a shared interest in the product chain. Differences in rationales were found in-between different practitioner roles. Here, sustainability managers proved to hold an important role as potential facilitators, especially in-between discussions with purchasing and sales managers, because they shared many of the rationales of both purchasing and sales managers.

The "business case" was identified as both the most important rationale *and* challenge expressed by all practitioner roles and at all product chain positions. It proved to be important in two different ways, both within the respective companies and also jointly for the product chain coalition.

Overall, many rationales and challenges for engaging in this new type of practice were shared by the member companies, despite the different backgrounds and LCM experience of the companies. In conclusion, this study shows that LCM does not have to be limited to the corporate sphere and that product chain LCM is sought as a way to bring value for these companies, despite their different positions in the product chain.

ACKNOWLEDGEMENTS

The authors would like to extend their appreciation to the companies that took part and made this study possible. The authors would also like to thank the company who provided financial support for this study, but that would like to remain anonymous.

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REFERENCES

Balkau, F., & Sonnemann, G. (2010). Managing sustainability performance through the value-chain. *corporate governance. The International Journal of Business in Society*, *10*(1), 46–58. https://doi.org/10.1108/14720701011021102

Baumann, H. (2012). Using the life cycle approach for structuring organizational studies of product chains. In *Greening of Industry Network 2012 conference*.

Baumann, H., Lindahl, M., Scandelius, C., Schmidt, K., & Sonnemann, G. (2017). Preface: Recognizing management in LCM. *The International Journal of Life Cycle Assessment*, *23*(7), 1351–1356.

Baumann, H., & Tillman, A. M. (2004). *The hitch hiker's guide to LCA. An orientation in life cycle assessment methodology and application*. Lund: Studentlitteratur.

Berkhout, F., & Howes, R. (1997). The adoption of life-cycle approaches by industry: Patterns and impacts. *Resources, Conservation and Recycling*, *20*(2), 71–94. https://doi.org/10.1016/S0921-3449(97)01199-3

Bey, N. (2018). Life cycle management. In M. Hauschild, R. Rosenbaum, & S. Olsen (Eds.), *Life cycle assessment: Theory and practice*. Dordrecht Heidelberg New York London: Springer. https://doi.org/10.1007/978-3-319-56475-3_22

Bey, N., Hauschild, M. Z., & McAloone, T. C. (2013). Drivers and barriers for implementation of environmental strategies in manufacturing companies. *CIRP Annals - Manufacturing Technology*, *62*(1), 43–46. https://doi.org/10.1016/j.cirp.2013.03.001

Boons, F. (2000). Products. In F. Boons, L. Baas, J. J. Bouma, A. de Groene, & K. Le Blansch (Eds.), *The changing nature of business*. Utrecht, the Netherlands: International Books.

Boons, F., & Berends, M. (2001). Stretching the boundary: The possibilities of flexibility as an organizational capability in industrial ecology. *Business Strategy and the Environment*, *10*(2), 115–124. https://doi.org/10.1002/bse.277

Broch, F., Warsen, J., & Krinke, S. (2015). Implementing life cycle engineering in automotive development as a helpful management tool to support design for environment. In G. Sonnemann, & M. Margni (Eds.), *Life cycle management*. Netherlands: Springer. https://doi.org/10.1007/978-94-017-7221-1_23

Broström, A. (2012). Firms' rationales for interaction with research universities and the principles for public co-funding. *The Journal of Technology Transfer*, *37*(3), 313–329. https://doi.org/10.1007/s10961-010-9177-4

Bryman, A., & Bell, E. (2007). *Business research methods* (2nd ed.). Oxford: Oxford University Press.

Carballo-Penela, A., Mateo-Mantecón, I., Alvarez, S., & Castromán-Diz, J. L. (2018). The role of green collaborative strategies in improving environmental sustainability in supply chains: Insights from a case study. *Business Strategy and the Environment*, *27*(6), 728–741. https://doi.org/10.1002/bse.2027

Charmaz, C. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. London: Sage.

Czarniawska, B. (2014a). *A theory of organizing* (2nd ed.). Cheltenham, UK: Edward Elgar.

Czarniawska, B. (2014b). *Social science research: From field to desk*. London: SAGE Publications Ltd.

De Bakker, F., & Nijhof, A. (2002). Responsible chain management: A capability assessment framework. *Business Strategy and the Environment*, *11*(1), 63–75. https://doi.org/10.1002/bse.319

Fava, J. A. (1997). LCA: Concept, methodology, or strategy? *Journal of Industrial Ecology*, *1*(2), 8–10. https://doi.org/10.1162/jiec.1997.1.2.8

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, *12*(2), 219–245. https://doi.org/10.1177/1077800405284363

Freidberg, S. (2017). Big food and little data: The slow harvest of corporate food supply chain sustainability initiatives. *Annals of the American Association of Geographers*, *107*(6), 1389–1406. https://doi.org/10.1080/24694452.2017.1309967

Giunipero, L. C., Hooker, R. E., & Denslow, D. (2012). Purchasing and supply management sustainability: Drivers and barriers. *Journal of Purchasing and Supply Management*, *18*(4), 258–269. https://doi.org/10.1016/j.pursup.2012.06.003

Gold, S., Seuring, S., & Beske, P. (2010). Sustainable supply chain management and inter-organizational resources: A literature review. *Corporate Social Responsibility and Environmental Management*, *17*(4), 230–245.

Golden, B. R. (1992). The past is the past—Or is it? The use of retrospective accounts as indicators of past strategy. *Academy of Management Journal*, *35*(4), 848–860.

Golden, J. S., Subramanian, V., & Zimmerman, J. B. (2011). Sustainability and commerce trends. *Journal of Industrial Ecology*, *15*(6), 821–824. https://doi.org/10.1111/j.1530-9290.2011.00381.x

Hahn, T., Preuss, L., Pinkse, J., & Figge, F. (2014). Cognitive frames in corporate sustainability: Managerial sensemaking with paradoxical and business case frames. *Academy of Management Review*, *39*(4), 463–487.

Handfield, R., Sroufe, R., & Walton, S. (2005). Integrating environmental management and supply chain strategies. *Business Strategy and the Environment*, *14*(1), 1–19. https://doi.org/10.1002/bse.422

Hunkeler, D., Saur, K., Rebitzer, G., Finkbeiner, M., Schmidth, W. P., Jensen, A., … Christiansen, K. (2003). *Life cycle management*. Pensacola (FL): SETAC Press.

Jørgensen, T. H. (2008). Towards more sustainable management systems: Through life cycle management and integration. *Journal of Cleaner Production*, *16*(10), 1071–1080. https://doi.org/10.1016/j.jclepro.2007.06.006

Linnanen, L. (1995). Life cycle management: Integrated approach towards corporate environmental issues. *Business Strategy and the Environment*, *4*(3), 117–127. https://doi.org/10.1002/bse.3280040303

Lozano, R. (2015). A holistic perspective on corporate sustainability drivers. *Corporate Social Responsibility and Environmental Management*, *22*(1), 32–44. https://doi.org/10.1002/csr.1325

Meehan, J., & Bryde, D. (2011). Sustainable procurement practice. *Business Strategy and the Environment*, *20*(2), 94–106. https://doi.org/10.1002/bse.678

Meima, R. (2002). Corporate environmental management—managing (in) a new practice area. PhD dissertation. Lund Business Press: Lund.

Müller, M, & Bessas, Y. (2017). Potenziale von Brancheninitiativen zur nachhaltigen Gestaltung von Liefer- und Wertschöpfungsketten. Universität Ulm.

Nicolini, D. (2012). *Practice theory, work, and organization: An introduction*. Oxford: University Press: Oxford.

Nilsson-Lindén, H., Baumann, H., Rosén, M., & Diedrich, A. (2018). Organizing life cycle management in practice: Challenges of a multinational manufacturing corporation. *The International Journal of Life Cycle Assessment*, *23*(7), 1368–1382. https://doi.org/10.1007/s11367-014-0818-y

Poikkimäki, S. (2006). Look closer to see further: Exploring environmental life cycle management, LCM. Ph.D. thesis, School of Business and Economics, University of Jyväskylä, Jyväskylä, Finland.

Power, W. (2009). Life cycle management: How business uses it to decrease footprint, create opportunities and make value chains more sustainable. United Nations Environment Programme & Society of Environmental Toxicology and Chemistry Europe.

Radhakrishnan, S. (2015). The Sustainable Apparel Coalition and the Higg Index. In S. Muthu (Ed.), *Roadmap to sustainable textiles and clothing* (pp. 23–57). Singapore: Springer.

Remmen, A., Jensen, A., & Frydendal, J. (2007). *Life cycle management: A business guide to sustainability*. Nairobi: UNEP/SETAC.

Saling, P. (2015). Sustainability improvements and life cycle approaches in industry partnerships. In G. Sonnemann, & M. Margni (Eds.), *Life cycle management*. Netherlands: Springer. https://doi.org/10.1007/978-94-017-7221-1_10

Sánchez, I. G., Wenzel, H., & Jørgensen, M. S. (2004). Models for defining LCM, monitoring LCM practice and assessing its feasibility. *Greener Management International*, *2004*(45), 9–26.

Schnittfeld, N. L., & Busch, T. (2016). Sustainability management within supply chains—A resource dependence view. *Business Strategy and the Environment*, *25*(5), 337–354. https://doi.org/10.1002/bse.1876

Seuring, S., & Gold, S. (2013). Sustainability management beyond corporate boundaries: From stakeholders to performance. *Journal of Cleaner Production*, *56*, 1–6. https://doi.org/10.1016/j.jclepro.2012.11.033

Silverman, D. (2011). *Interpreting qualitative data: A guide to the principles of qualitative research* (4th ed.). London: SAGE Publications Ltd.

Sonnemann, G., Gemechu, E. D., Remmen, A., Frydendal, J., & Jensen, A. A. (2015). Life cycle management: implementing sustainability in business practice. In G. Sonnemann, & M. Margni (Eds.), *Life cycle management*. Netherlands: Springer. https://doi.org/10.1007/978-94-017-7221-1_2

Strothmann, P., Bricout, J., Sonnemann, G., & Fava, J. (2015). Communication and collaboration as essential elements for mainstreaming life cycle management. In G. Sonnemann, & M. Margni (Eds.), *Life cycle management*. Netherlands: Springer. https://doi.org/10.1007/978-94-017-7221-1_20

Swarr, T., & Fava, J. (2007). A capability model for life cycle management. In *LCM 2007: Third International Conference on Life Cycle management*.

UNEP/SETAC Life Cycle Initiative (2012). Greening the economy through life cycle thinking: Ten years of the UNEP/SETAC Life Cycle Initiative. United Nations Environment Programmme. Retrieved from http://www.unep.fr/shared/publications/pdf/DTIx1536xPA-GreeningEconomythroughLifeCycleThinking.pdf.

Vermeulen, W. J., & Seuring, S. (2009). Sustainability through the market–the impacts of sustainable supply chain management: Introduction. *Sustainable Development*, *17*(5), 269–273.

Walker, H., Di Sisto, L., & McBain, D. (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purchasing and Supply Management*, *14*(1), 69–85. https://doi.org/10.1016/j.pursup.2008.01.007

Welford, R. (1993). Breaking the link between quality and the environment: Auditing for sustainability and life cycle assessment. *Business Strategy and the Environment*, *2*(4), 25–33. https://doi.org/10.1002/bse.3280020404

Welford, R. (Ed.) (1999). *Corporate environmental management 1: Systems and strategies* (2nd ed.). London: Earthscan Publications Ltd.

Welford, R. (2003). Beyond systems: A vision for corporate environmental management for the future. *International Journal of Environment and Sustainable Development*, *2*(2), 162–173. https://doi.org/10.1504/IJESD.2003.003328

How to cite this article: Nilsson-Lindén H, Rosén M, Baumann H. Product chain collaboration for sustainability: A business case for life cycle management. *Bus Strat Env*. 2019;1–13. https://doi.org/10.1002/bse.2388